Surviving Residential Fires

Strategic Analysis of Community Risk Reduction

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ABSTRACT

Ten fatal fires in Battle Creek, claimed 16 lives between 1992-1997, and created a problem for the Battle Creek Fire Department. The purpose of the research project was to learn the history of fatal fires in Battle Creek, learn about the local usage of smoke detectors in Battle Creek, and learn the components of a program to reduce fire fatalities. The purpose was pursued through the following six research questions:

1. What is the history of fatal fires in Battle Creek, including date, address, number of victims, age of victims, sex of victims, cause of fire?
2. What percentage of residential households in Battle Creek have an operable smoke detector?
3. What percentage of residential households in Battle Creek have operable detectors meeting minimum code requirements?
4. What are the principle reasons for non-operable smoke detectors in residential households in Battle Creek?
5. How does Battle Creek compare to available national benchmarks regarding fatal fires?

Research question number one was pursued through historical research and determined there were 28 fatal fires in Battle Creek, claiming 36 lives, from 1947 through 1997.

Research questions two, three and four were pursued through descriptive research, by using a questionnaire and conducting a local survey. The sample was randomly selected and large enough (377 respondents) to generalize the results to the city

population with a 95% level of confidence. But because the interviews were conducted on a phone, the respondents were not considered representative. Ninety-seven percent of the 377 households surveyed had at least one detector. Sixty-five percent of the households met minimum code requirements for smoke detectors. Only 8% of the respondents had dead batteries and only 3% had missing batteries.

Research questions five and six were pursued through evaluative research, based on information processed in a literature review. Examining the most recent national statistics found the fatal fire rate, for cities of similar size to Battle Creek, at 13.2 deaths per million population from 1992-1996. The Battle Creek rate was 121% higher at 29.2. However, Battle Creek has a history of fatal fires that occur sporadically and the current episode of fatal fires was viewed as historically consistent.

A prevention program to reduce fire fatalities would include the following components: learning to avoid preventable fires occurring in the home, learning and practicing a home fire escape plan, and learning to properly install and or maintain smoke detectors. The project produced the following 5 recommendations:

1. View the fire fatalities of 1992-1997 as an episode, rather than trend.
2. Create a coalition to guide an educational intervention program.
3. Increase educational interventions for the hard-to-reach.
4. Create a full time fire safety educator position.
5. Requiring existing rental property to meet the smoke detector requirements for new construction.
6. Develop a program assuring every household has working detectors.

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INTRODUCTION

There were four separate fatal fires in the city of Battle Creek during 1997. These four fires produced a combined total of eight fire fatalities. Battle Creek has a population of 54,435 according to the most recent census data. These numbers produce a per capita fatal fire death rate of 146 deaths per million citizens. The most current national figures show there were 4,035 deaths nationally from residential fires, accounting for a national civilian fire death rate of 18.8 deaths per million population (Karter, 1997).

The elevated civilian fire death rate in Battle Creek is a problem for the Battle Creek Fire Department (BCFD) because of the following reasons; the public looks to the city government and the fire department to solve fire related problems, the increase in fire deaths is contrary to the department's mission of saving lives, the BCFD has not been able to explain why civilian fire deaths are increasing, and the BCFD does not have a plan for changing the civilian fire death rate.

The purpose of the research project is to learn the history of fatal fires in Battle Creek, learn about the local usage of smoke detectors in Battle Creek, and learn the components of a program to reduce fire fatalities. This purpose will be pursued through the following research questions:

1. What is the history of fatal fires in Battle Creek, including date, address, number of victims, age of victims, sex of victims, cause of fire?
2. What percentage of residential households in Battle Creek have an operable smoke detector?

3. What percentage of residential households in Battle Creek have operable detectors meeting minimum code requirements?
4. What are the principle reasons for non-operable smoke detectors in residential households in Battle Creek?
5. How does Battle Creek compare to available national benchmarks regarding fatal fires?
6. What does the literature of the fire service identify as the primary components of a program to reduce fire deaths?

Research question number one will be pursued through historical research, using electronic data bases, archived records, and interviews. Research questions two, three and four will be pursued through descriptive research, by using a questionnaire and conducting a local survey that permits knowledge gained from the sample to be generalized to the population with a 95% level of confidence. Research questions five and six will be pursued through evaluative research, based on information processed in a literature review.

BACKGROUND AND SIGNIFICANCE

Prior to conducting this research project, there was not a data base for the BCFD regarding fatal fires. In January 1995, this researcher requested a five year history from the State of Michigan regarding certain fire statistics that would be the basis of future bench marking efforts. Since then civilian fire fatalities have been tallied.

In Battle Creek, from 1990 through 1994, there were four fatal fires involving a combined total of five fatalities (two children, one 74 year old male, one 34 year old handicapped male, and one 49 year old male). This was an average of 1.0 fire deaths per year (18.3 fire deaths per million population) and was similar to national fire death rates. When this data was obtained, it generated no significant staff interest.

In 1995 there was one fire involving the deaths of two children. In 1996 there was one fire death involving a 79 year old female. As the year 1996 ended, the fire deaths of 1995 and 1996 were not considered noteworthy. In retrospect, those two years produced significant data. The five deaths from 1990 to 1994 occurred in 1992, 1993 and 1994. When combined with the 1995 and 1996 data, the five year average is 1.6 deaths per year or 29.2 deaths per million population. This compares very unfavorably with the national five year average from 1992 through 1996 of 13.2 deaths per million population for all communities of similar size. This places the five year average fire death rate at 121% above the national average for similar size communities.

In light of this retrospective review, Battle Creek had a serious fire fatality problem prior to 1997, although it had not been recognized. The year 1997 was an anomaly for the BCFD. It wasn't until the year ended that the uniqueness of the problem became

recognizable. During the five years from 1992 through 1996 there were eight fire fatalities from six fatal fires. In 1997 there were eight fire fatalities in a single year from four separate fatal fires.

The year 1997 served as a wake up call for the BCFD, because prior to 1997 there was a fatal fire problem, but it was unrecognized. The year 1997 was so devastating for the BCFD and the community it serves, that interest was created to closely examine the issue of fire deaths. This interest first appeared early in 1998, when this researcher met with the Chief of the BCFD. The meeting was to discuss this researcher's involvement in the Strategic Analysis of Community Risk Reduction (SACRR) class to be held in May 1998 at the National Fire Academy (NFA). The class was selected as the third year elective in the Executive Fire Officer Program (EFOP). Prior to attending the class, students are mailed a two page assignment sheet regarding the identification of an unresolved community risk issue relating to health or injury. The community risk issue identified during the meeting with the Chief of the BCFD and selected to be worked on through the SACRR class, was "surviving a structure fire" (NFA, 1998).

While participating in the SACRR class during May 1998, this researcher determined that more data was needed regarding the problem, before an effective intervention or remedy could be implemented. Research questions one through five attempt to gain the additional data. Research question six attempts to identify intervention techniques that will be used to meet the goal of decreasing the number of citizens who fail to survive a residential structure fire.

LITERATURE REVIEW

Surviving fire is based on the principles of learning that a fire condition exists (detection and notification) and having a plan to respond when learning that a fire condition exists (fire safety education). Detection and notification does not solve the problem of surviving fires. However, it is the first and most important step to learn how to survive a fire, because of these three common characteristics in most fatal fires:

1.) Fatal residential fires most commonly occur when residents are asleep;

2.) Fatal fires burn for longer periods of time before they are discovered;

3.) Most deaths are due to smoke inhalation rather than burns. (McLoughlin, p.858, 1985)

Detection and notification (early warning) can best be accomplished through available smoke detector technology. The battery version combines effectiveness, with low cost, and easy installation. In 1970 it was estimated that less than 5 percent of American households had installed smoke detectors. “In 1975, the BOCA (Building Officials and Code Administrators International) building code was amended to require a smoke detector protecting the bedroom area in each dwelling unit” (McLoughlin, p.858, 1985). Local ordinances in Battle Creek, Michigan have adopted the BOCA Building Code and Fire Prevention Code (FPC). The BOCA- FPC requires a minimum of a single station, battery operated smoke detector, on each level of a dwelling and also a detector in the immediate vicinity of all sleeping rooms (BOCA, 1993).

Current estimates place the percent of homes in the United States with a smoke detector at ninety-three, which is in stark contrast to the fact that three out of five fire

fatalities occur in homes without smoke detectors (Douglas, 1998). The case for smoke detectors was articulated with impeccable logic in an editorial in the Operation Life Safety Newsletter.

> For years the fire service has proclaimed 'We save lives' ... real world statistics don't bear that out ... How many firefighters do you know who have ever saved a life? Contrast that to how many potential victims got themselves out of a fire. Then contrast the saves to the number of lives lost. The numbers are not as good as we would like ... This message is for public-policy makers who need to understand the risks and solutions that don't require increased budgets ... 84% of all fatal fires burn ten or more minutes before the fire department is notified... Notification alone would result in dramatic reductions in life loss ... What is needed are hard-wired detectors connected by phone lines that are monitored by a private central receiving station. (Stevens, p. 6, 1995)

Having a plan, when learning that a fire condition exists, is the next most important step. The failure to make plans regarding a response to a notification that a fire condition exists, explains why just having an operable smoke detector won't eliminate the risk of dying in a residential structure fire. The National Fire Protection Association (NFPA) conducted a national fire escape survey (Wolfe, 1998). In the survey, only 16% of the respondents had both planned and practiced an escape plan for their home. This helps explain why people die from fire in their own homes despite having smoke detectors. In the survey, 37 percent of the respondents said they would not leave the house immediately, if the smoke detector sounded in the middle of the night and they did smell smoke.

Early warning and escape planning are two major challenges for fire safety educators, to decrease fire fatalities. People must learn there are critically few minutes to respond to a smoke detector when sleeping and they must have and practice a plan to respond. The literature review must examine many separate issues relating to the issue of surviving fires. One issue is who is actually dying in fires.

> The elderly and the very young are the groups at highest risk. Children under five years of age continue to have double the national fire death rate. Risk of fire death drops off sharply for children between the ages of 5 and 19, then increases slowly with age. The population group aged 70 and older has one-and-one-half to three times the national average fire death rate, with the risk increasing sharply for people over 80; two-thirds of the people who die in fires are neither very young or very old (National Fire Data Center, p. 12, 1997).

"Operating smoke detectors have the ability to reduce fire death and injury rates" (Michigan Fire Service News, p. 7, October 1995). However, the fire service is learning that smoke detectors are responsible for decreasing the number of fires as well as fire deaths. This is presumably because many small fires are discovered early in the incipient stage of fire growth and are easily and quickly suppressed by the occupant without summoning the fire department. "Homes that have reported fires are less likely to have smoke detectors than the homes that do not have fires. That is, detectors are found least often in the places that need them most" (National Fire Data Center, p. 15, 1993).

This same concept was recently expounded upon in an editorial for Fire Chief magazine. Citing 1974 and 1984 national surveys of unreported residential fires, smoke

detectors are credited with changing the number of unreported residential fires from 91% to 96% of all residential fires. “This was consistent with the theory that residential smoke detectors were (and presumably still are) enabling people to extinguish a greater proportion of fires themselves, without summoning help” (Baltic, p. 7, 1998).

Numerous studies have attempted to identify the reasons for inoperable smoke detectors. In the smoke detector operability survey conducted by the Consumer Product Safety Commission (Smith, 1994), 60 percent of inoperable detectors were caused because the detectors were disconnected from their power sources. The primary reasons for the disconnections were either the occupants forgot they were disconnected or they were intended to be disconnected because of nuisance alarms. A review of the CPSC survey was reported in the NFPA Journal. In summarizing the reason for inoperable detectors the author states “the principal problem is the human factor: lack of knowledge, neglect, and misapplication” (Ahrens, p. 102, 1998).

Benchmarking fire data is best begun with an examination of national fire service incident data, compiled in a report format, by the NFPA. There were “4,035 fire deaths in the home, in 1996" (Karter, p. ii, 1997). Those deaths are divided by 3,470 occurring in one and two family dwellings and 565 occurring in apartments. Fatalities occurring in residential structures represent 81% of all fire fatalities. Cities with populations from 50,000 to 99,999 averaged 90 residential structure fires, 0.8 civilian fire deaths, and $916,800 in property loss during 1996, the most recent year available in fire statistics at the national level (Karter, 1997). In Battle Creek there were 126 residential structure fires, 1.0 civilian deaths, and $1,264,613 in property loss during 1996 (BCFD, 1997).

The U.S. Fire Problem Overview Report (Hall, March 1998) is an excellent source of national statistics that are useful in comparing how a fire department performs in relation to national averages. The United States averaged 17.8 fire deaths, per million population, from 1992-1996. The North Central section of the United States had the second highest area average at 18.0. The same report averages the number of fatalities in 1992-1996 and computes a ratio of average deaths per thousand fires. The ratios are then plotted on a graph showing community sizes. Cities with 50,000-99,999 populations average 2.2 fire deaths per 1,000 fires. This average remains constant for all communities above 10,000 populations. The average number of fire deaths, per 1,000 fires, in Battle Creek, averaged from 1992-1996 is 4.01. The average number of fire deaths, per million population, in Battle Creek, averaged from 1992-1996 is 29.2.

Accurate estimates of national fire activity were very rough prior to the advent of the National Fire Incident Reporting System, advocated in America Burning (NCFPC, 1973). Home fire deaths were at their peak in 1978 when 6,015 deaths occurred. Home fire deaths reached a low of 3,425 in 1994, before showing modest increases during 1995 and 1996 (Karter, 1997).

> Two high-risk age groups - ages 0-5 and ages 65 and over - have been increasing their domination of home fire deaths in the past decade and a half. Together they accounted for 38.7 percent of home fire deaths in 1980 and for 44.8 percent in 1995. (Hall, January 1998)

"With home fire deaths still accounting for 80.9% of all fire deaths, fire safety initiatives targeted at the home remain the key to any reductions in the overall fire death

toll" (Karter, p. 10, 1997). The initiatives suggested by Karter are:

1. Increase fire safety education on preventing fires and avoiding injuries.
2. Increase people maintaining detectors and practicing escape plans.
3. Increased use of residential sprinklers must be aggressively pursued.
4. Seek more ways to make home products safer.
5. Identify special needs of high risk groups, i.e., children, elderly, and poor.

The most recent analysis of the interaction between smoke detectors and fatal fires establishes a crucial point, i.e., although 93 percent of U.S. homes are equipped with detectors, 45 percent of home fires occurred in homes with no detectors, and 58 percent of fatal fires occurred in homes with no detectors (Hall, January 1998).

When fire causes are examined for all U.S. home fires, cooking is the major cause at 22.3%, followed by heating 16.7%, incendiary 12.3%, and other equipment 10.0%. But when the causes of fatal fires are examined, careless smoking is the major cause at 22.9%, followed by incendiary 17.0%, heating 13.4%, and child playing at 10.3%. These causes parallel the primary area of origins in fatal fires, which are living rooms and bedrooms. The association between areas of origin and fire causes is based on the upholstered furniture that people use while smoking. This upholstered furniture is primarily located in living rooms and bedrooms.

A record search at the National Fire Academy library found 16 reports of smoke detector surveys conducted to determine smoke detector coverage and smoke detector operability. Some surveys lacked methodology permitting the results to be generalized to the overall population with significant levels of confidence, while the methodology was

sound and replicable in other cases. The most aggressive survey attempted to interview 22,000 residents, in person, over a two year period. The value of each of the surveys was based on bench marking departments and communities against required codes and national averages, in order to identify strengths and weaknesses.

If decreasing fatal fires is a goal of a department, then the first step must be determining the effectiveness of the smoke detector usage in the community. Once this is done, the results will guide the recommendations for improved levels of community safety. This theme was reiterated in each community smoke detector survey. All results identified the need for fire safety education regarding smoke detectors, to overcome the human factors affecting missing and inoperable detectors.

The NFPA Fire Protection Handbook (Cote, 1997) devotes a chapter to household fire warning equipment. Smoke detectors are reviewed historically and evaluated technologically. “Full effectiveness for household warning systems means the right number of the right kind of detectors, located in the right places and operating properly” (Schuchard, p. 5-59, 1997). Although each of these components were addressed by Schuchard, they are also specified in chapter two of NFPA 72, which is the National Fire Alarm Code. The human behaviors that are necessary to receive the full benefit of a smoke detector (escape planning) are also reviewed by Schuchard. However, despite proper escape planning and the code required use of battery powered detectors in homes built prior to 1975, he recommends that “even in existing households, smoke alarms should be powered by alternating current electricity with standby battery” (Schuchard, p. 5-59, 1997).

PROCEDURES

Research question number one is “What is the history of fatal fires in Battle Creek, including date, address, number of victims, age of victims, sex of victims, cause of fire?” This was pursued through historical research. Step one was contacting the Office of the State Fire Marshal and requesting a query of the State of Michigan electronic data base for incident reporting. Step two was to query the electronic data bases maintained for BCFD (July 1995-present) and the city of Battle Creek (January 1986-July 1995). Queries provided incident numbers, addresses, and dates to support manual searches of archived incident reports.

The queries of the city and state data bases was highly deficient. The state could only access records through 1990 and failed to identify two known fatal fires in 1993 and one in 1995. As a result, the state was asked to pursue a search of any and all hard copy records. The result was they did not have records indicating civilian fire fatalities for any individual municipalities prior to 1990. The query of the city data bases was more accurate and went back to 1986. However, a known fatal fire in 1988 was omitted.

Fire investigative reports have been maintained in hard copy, archived files, in the BCFD Fire Prevention Bureau, since 1947. Each individual file was searched manually, by this researcher, to identify former fatal fires in Battle Creek. Once all fatal fires had been identified, they were summarized in a spread sheet format. Finally, the fatal fire summary was given a subjective trend analysis by this researcher. The trend analysis is based on methods of fire death rate reporting obtained in the literature review, i.e., deaths per million population and deaths per thousand fires.

Research questions two, three, and four are attempts to determine the smoke detector usage in Battle Creek. This was accomplished through descriptive research, by using a questionnaire and conducting a local survey. The sample for the survey was a random selection obtained from the Battle Creek City Assessor. The sample was derived electronically from the data base of improved residential properties. The sample was the output of a computer program specifically written to create a sample and assure that the sample is truly random.

The survey was designed to assure a 95% level of confidence that the results of the sample could be generalized to the larger population, i.e., improved residential properties in Battle Creek. This assurance came from the randomization of the sample and the size of the sample. The Statistical Package for the Social Sciences (SPSS) computed the minimum sample size, for a population of 17,048 residential properties with a 95% significance level, at 350. However, the student manual for the NFA course Executive Development identifies a minimum sample size for a population of 17,048 residential properties at “377" (NFA, p. 3-69, 1996). The higher of the two sample sizes was selected.

The survey was intentionally kept simple, utilizing close-ended and forced-choice questions (see Appendix A-1). A questionnaire was used on phone interviews. The questionnaire included a script for the interviewer to read, assuring consistency of interviews. All interviews were completed by this researcher, a fire inspector, or a part-time data clerk employed by the BCFD. Although only 377 questionnaires needed to be completed, the initial sample was a list of 1,000 random residential properties because of anticipated difficulties contacting individuals, i.e., not at home, won’t answer phone, can’t

get a phone number, won't cooperate with the survey, etc.

Of the 1,000 residential properties, the last 13 were not used. Of the 987 that were used, 564 did not have phone numbers listed in the 1997 Battle Creek, Michigan Polk City Directory (Polk, 1997). Of the 423 randomly selected properties that had phone numbers listed in the Polk Directory, seven either hung up, refused to participate, or were businesses operating within residential properties. Of the remaining properties with listed phone numbers, 377 were interviewed and the remaining 39 never answered their phones.

After the completion, the respondents were categorized by political ward, as a check to see if the sample was representative of the city. There are five political wards. The population of each ward is within ten percent of the population of every other ward. The survey respondents were distributed as follows:

Ward 1:	33
Ward 2:	31
Ward 3:	110
Ward 4:	98
Ward 5:	105
Total	377

The totals above show ward one and two were not within ten percent of wards three, four and five. Thus, the sample was not representative of the city. When this researcher discovered the sample was not representative, the chief of the BCFD and chair of the EFOP at the NFA was consulted. The sample could be modified to become representative by going to 70 households in both ward one and two and conducting on-site interviews.

However, after consultations, this researcher deemed that enough information was derived from the survey, and there was not a need to determine how the responses would change when the sample becomes representative.

Research question number five is how does Battle Creek compare to available national benchmarks regarding fatal fires? Research question five will be pursued through evaluative research, based on information processed in a literature review. The traditional methods employed by the fire service to describe the frequency and scope of fatal fires were identified in the literature review of this project as fire deaths per million population and fire deaths per thousand fires. The fire service literature examines five year averages, using those two measures, to compensate for yearly spikes in a graph that are anomalies. These averaged five year measures are then compared to the statistics available through the recent annual reports of the BCFD.

Research question number six is what does the literature of the fire service identify as the primary components of a program to reduce fire deaths? This research question number six will use evaluative research and be answered through information processed in the literature review.

Limitations: Research question one was limited by the lack of available records prior to 1947. The survey, which answered research question two, three, and four did not include apartment complexes or agricultural property. Residential property without phone numbers listed in the Polk Directory were omitted. People without phones, people out of town during the six days the calls were made, and people who did not answer their phone were omitted from the survey. These limitations contributed to the randomly selected

sample members failing to be representative of the population.

Research assumptions: The first assumption is the respondents honestly reported conditions within their homes. Second is the data supplied for bench marking is accurate. Third is there were no missing fatal fire investigative reports from the BCFD archives. The following definitions are specific to this research project.

Improved residential properties: Includes one and two family dwellings and apartment buildings of four or fewer apartments. Does not include agricultural property or commercial based apartment buildings. It does include condominiums.

Smoke detector: An electronic device installed within a structure, which has the ability to determine the presence of smoke and the ability to transmit a signal (alarm) if smoke is detected. Smoke detectors may be based on the principle of ionization, or photoelectric, or may combine the principles. The detectors may be powered by batteries, alternating current (AC) electricity, or may use the combination of batteries and AC.

Fire fatality: Fire fatality, death, fire death and fatality are used interchangeably throughout this paper. A fire death is defined as the death of a human, occurring as a direct consequence of the human experiencing a residential fire.

RESULTS

Research question one: There were 28 fatal fires, producing 36 fire deaths, within Battle Creek city limits, from 1947 through 1997 (see Appendix B). Figure one shows the breakdown of Battle Creek fire deaths by age and figure two shows how fatal fires can also be viewed by fire cause.

Research question two: The answer to question number two is ninety-seven percent of the sample households (367 out of 377) had at least one smoke detector. This is much higher than expected and above the national norm of ninety-three percent cited in the literature review.

Figure 1: Fatal fires displayed by victims age

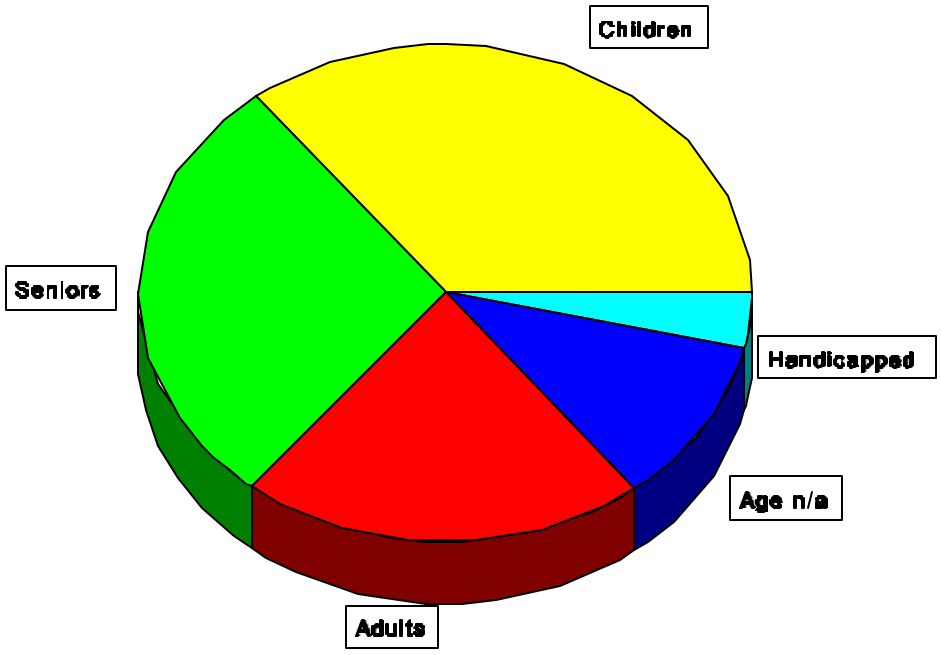
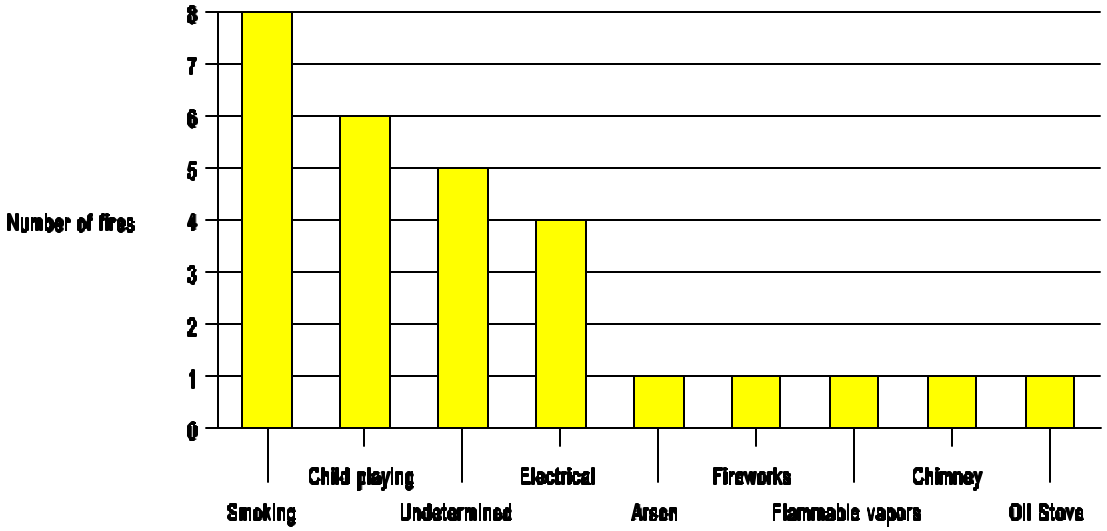


Figure 2: Causes of fatal fires in Battle Creek



Research question three: The results of the survey showed 246 households out of the 377 interviewed (65%), reported to have at least the minimum number of detectors required by Battle Creek city ordinance. Of the 246 reports of adequate detectors, 43 were reported using AC electricity (17%) and the remaining 203 households depended on battery operated detectors (83%). Of the 203 households using battery operated detectors, 148 were reported to have good batteries, 29 households did not want to test the detectors, 18 households had dead batteries in detectors, and 8 households had missing batteries in detectors.

If the 29 households with untested detectors are distributed similarly to the tested households, then 25 will have good batteries, one will have missing batteries, and three will have dead batteries. When the estimates of the untested detectors are combined with the reports of the tested detectors, then 173 households have battery detectors with good batteries, 21 have battery detectors with dead batteries, and 9 have battery detectors with

missing batteries.

To find the total number of homes meeting minimum code requirements for detectors, and which also have operable detectors, the 173 homes with good batteries are added to the 43 homes with detectors using AC electricity. Therefore, 216 homes of the 377 surveyed, or 57 percent, had operable smoke detectors meeting minimum code requirements.

Research question four: The survey showed 42 out of 377, or eleven percent of the survey households, had inoperable detectors. Eight percent, or 30 out of 377 households, had dead batteries. Three percent, or 12 out of 377 households, had batteries missing from the detectors.

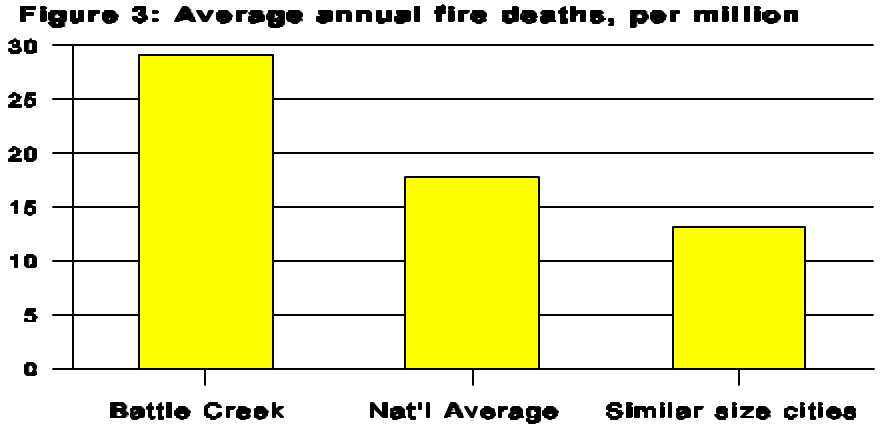
Research question five: There were eight deaths from six fires during the five year time frame from 1992 through 1996. These years are examined because they are the most recent national figures available. This converts to an average annual fire death rate of 29.3 fire fatalities, per million population. This compares to a national average of 17.8 fire fatalities per million population or to 13.2 fire fatalities per million population for cities with populations of 50,000 through 99,999.

Fire deaths can also be benchmarked by fatalities per 1,000 fires. There were 1,995 fires, from 1992 through 1996, in Battle Creek, producing eight deaths. This computes to 4.01 deaths per 1,000 fires. This unfavorably compares to a 2.2 national rate of similar size cities. Figure three illustrates the disproportion of fire deaths Battle Creek experienced from 1992 through 1996.

Research question six: What does the literature of the fire service identify as the primary components of a program to reduce fire deaths? The literature review found that there are actions that can be taken locally and nationally, and only the former will be reviewed here. According to the NFA manual for SACRR class, a program to reduce civilian fire deaths is termed a prevention (community risk reduction) program. A prevention program to reduce fire fatalities would include the following components:

1. Learn to avoid preventable fires occurring in the home.
2. Learn and practice a home fire escape plan.
3. Learn to properly install and maintain smoke detectors (Karter, 1997).

An injury prevention program for reducing fire fatalities could use primary, secondary, or tertiary prevention measures. These measures could interface with the



traditional interventions of education, engineering and enforcement (NFA, 1998). The effect of such a program would be to alter the fatal consequences of fires before the fire (pre-event), during the fire (event), and after the fire (post-event).

The interventions, measures, goal, and program components have been specified.

Before these are combined into an effective injury prevention program, the most important ingredient must be added, which is coalition support. In the Strategic Management of Change course, the necessity of grassroots support was stressed when implementing change. This year the SACRR course stressed obtaining community support through coalition building, when implementing injury prevention programs. An effective program for reduction of civilian fire fatalities in Battle Creek must have a broad support base that includes community organizations and BCFD union personnel.

DISCUSSION

Battle Creek fatal fires: This was the focus of research questions one and five. Eight deaths from six fires, during 1992-1996, places Battle Creek at 121% above the fire death rate for similar size cities, when averaged for the same number of years. The rate of fatal fires in Battle Creek appears to be a problem and to be escalating.

The more people understand a problem, generally the less overwhelming and threatening the problem is. This seems to apply toward the fire death rate in Battle Creek. The eight deaths from six fires from 1992-1996, combined with the eight deaths from four fires in 1997, present an image of an overwhelming high, and escalating, fire death problem. However, since a record of all fatal fires has now been established, the recent deaths can be viewed from the perspective of history, as shown in Table 1.

Table 1: Fire deaths clustered by years in Battle Creek.

Deaths/yr	Years	# of yrs	# fatal fires	# fire deaths
.0	1947-50	4	0	0
1.4	1951-56	6	7	7
.0	1957-59	3	0	0
.8	1960-66	7	4	6
.0	1967-76	10	0	0
1.0	1977	1	1	1
.0	1978-82	5	0	0
1.0	1983-88	6	6	6
.0	1989-91	3	0	0
2.6	1992-97	6	10	16

When viewed as clusters of years, Battle Creek is seen to have a sporadic problem of fire deaths that dates back to the early 1950's. When the 51 years of history are used to produce the number of average annual fire deaths per million population, the fire death rate of 12.9 is created for the years 1947-1997. That number changes the whole view of fire deaths in Battle Creek. As table 1 shows, there were 7 fatal fires during the six years from 1951-1956 and there was 10 fatal fires during the six years from 1992-1997. Since 1951-56 was an isolated episode and neither a trend or harbinger of things to come, 1992-97 will likely be viewed, in the future, similarly.

Survey results: It was unexpected, when it was discovered the sample was not representative, especially after caring to assure the sample was random and large enough. Although 97 percent of the sample had at least one smoke detector, this researcher does

not believe that number can be generalized to the city population. Ninety-seven percent is much better than expected and is also above the CPSC survey (Smith, 1994) and NFPA survey (Hall, 1998) of 93 and 90 percent, respectively. Likewise, the following findings were beyond expectations:

1. Only thirty-five percent of the homes didn't meet code requirements.
2. Only seven percent of the homes had dead batteries.
3. Only three percent of the homes had missing batteries.

The unexpected positive nature of the findings could be due to the sample not being representative of the city. However, an alternative explanation is the recent rash of fire fatalities and the subsequent media coverage has heightened the sense of community fire safety. In truth, it is probably a combination of both phenomena that produce such positive survey results.

Components of a program to reduce fire deaths: The first component of a program to reduce fire deaths is learning to avoid preventable fires. Reducing the frequency of fires is difficult for two reasons. First, the frequency of fires is correlated to the socio-economic living conditions of a community (Moody, 1997) and altering those influences is beyond the mission of the fire service. Educational programs can be developed which compensate for the disparity of fires associated with poverty. This approach is called "Reaching the Hard-to-Reach" (Kelenkamp, Lundquist, Schaenman, 1994).

The second reason for the difficulty in reducing the frequency of fires is the nature of the preventive measures, which are categorized as voluntary and active. The best

preventative measures are mandatory and passive. Voluntary active measures are taught through educational interventions. These interventions are the most widely used approach to prevent injuries and are the easiest interventions to implement (NFA, 1998). However, the educational intervention approach has the following drawbacks:

- Limited success when used independently of other interventions.
- Requires long term commitment.
- Difficult to control learning environment.
- Must not only teach about the seriousness of problem, but must convince the person to take action steps.
- Reinforcement necessary on a continuous basis to make the desired behavior a habit.
- Effects may not be seen for years (NFA, p. 6-3, 1998).

The second component of a program to reduce fire deaths is learning and practicing a home fire escape plan. As mentioned in the previous discussion regarding the first component, the difficulty in learning and practicing home fire escape plans is the nature of the preventive actions, which are categorized as voluntary and active. As such, they are dependent also on educational intervention and the drawbacks previously cited.

The third component of a program to reduce fire deaths is learning to properly install and maintain smoke detectors. This component has the capacity to use more than educational intervention. To reach the hard-to-reach, who do not have detectors or who fail to maintain detectors, enforcement and engineering interventions are available for public policy makers.

Organizational implications: Each of the three components for reducing fire fatalities are currently practiced by the BCFD. The following actions of the BCFD support the goals of reducing fires and learning home fire escape plans: thorough fire investigations, fire prevention week activities, commercial building inspections, public relations programs at community events, providing free public fire safety education materials, providing a juvenile fire setter's program, teaching fire safety to children in schools through the Learn Not To Burn program and the BCFD Escape House program. The city of Battle Creek also has a local smoke detector ordinance supporting the national minimums identified in the BOCA and NFPA 72 codes. The BCFD has a close working relationship with the Code Compliance Department of Battle Creek, which legally processes violations of the local ordinance.

There are literally hundreds of programs practiced by fire departments in communities across the United States, which could be implemented in Battle Creek. The challenge is for coalitions to be developed, which will advocate for new programs. Partnerships were developed with school teachers for the Learn Not To Burn program, with the Red Cross for the Escape House program, and with the Burnham Brook Senior Citizens Center for the new Senior Citizens Smoke Detector program. However, partnerships are not enough. What is needed is the development of a coalition, which advocates for increased fire safety. Such a coalition must seek the support and input from fire fighters who have resistance to the concept of accepting fire prevention activities as major responsibility and mission.

RECOMMENDATIONS

The first recommendation is to not over react to the fire fatalities of 1992-1997, but to view them as a sporadic fire episode similar to the rash of fatal fires that occurred in 1951-1956. The recent fatal fire statistics are useful for bringing attention upon the issue of fire safety, and can be useful in public relations as describing the need for the media to focus attention on fire safety.

The second recommendation is for the creation of a coalition to guide the development of a fire safety educational intervention program. It is strongly urged that the coalition include members of the fire fighting division of the BCFD. The structure of this community coalition could take any of the three forms described below:

1. Pre-packaged coalitions: Examples of these are “Risk Watch” and “Safe Kids” programs that establish broad based coalitions of both citizens and key community organizations.
2. Advisory coalitions: Examples are boards and committees that are established to give input or guide policy, such as the Battle Creek Parks and Recreation Advisory Committee and the Michigan Fire Incident Reporting System Advisory Committee.
3. Master planning: Examples of master planning come from the USFA model and the fire department accreditation model developed through the International Association of Fire Chiefs. In both of these models, an assessment of community fire protection needs must be made with input from the community. That input can dovetail with the input needed to expand

the educational interventions needed to reduce the risk of dying in a structure fire.

The third recommendation is for increasing the educational interventions of the BCFD by addressing the needs of the hard-to-reach. Creating new community partnerships with other organizations already servicing the hard-to-reach is the key to implementing this recommendation. The following books are resources, for reviewing potential educational interventions, that will meet the fire safety needs of the hard-to-reach.

1. Directory of National Community Volunteer Fire Prevention Program: This is a review of existing community-based fire prevention education initiatives (National Criminal Justice Association, 1993).
2. Reaching the Hard-To-Reach: This is a collection of techniques to be used in developing educational interventions from fire prevention programs and other disciplines (Kelenkamp, Lundquist & Schaenman, 1994).
3. Fire Service Programs Across America: This is a review of fire department based programs using educational interventions. (USFA, 1990).

The fourth recommendation is for the creation of a full time fire safety educator position to be created in the BCFD. The creation of the position sends a message regarding the importance of fire safety education. This position is a necessary consequence of the two previous recommendations. This person would focus on developing a community fire safety coalition, developing partnerships with community organizations, lead the educational interventions toward the hard-to-reach, and issue professional quality fire safety information to the media on a regular basis. This can be

accomplished without increased cost to the BCFD by converting a vacant fire inspector position into a new fire safety educator position.

The fifth recommendation is to have the BCFD advocate for the modification of the local ordinance on smoke detectors, by requiring existing rental property to meet the smoke detector requirements for new construction.

The sixth and final recommendation is to have the BCFD develop a program which assures every household in Battle Creek has working smoke detectors, which meet the minimum code requirements. Components of the program would be:

A. Provide batteries and smoke detectors to any city household upon request. They could be dispensed from every fire station. The program could be funded by a private source. In addition to helping citizens and making the city safer, this would create excellent public relations.

B. Install batteries or detectors upon the request of any citizen who expresses difficulty with doing either. There are no direct costs associated with this and the public relations would be excellent. Citizens would direct requests to their neighborhood fire station.

C. The program would best be developed using a model that combines the approaches from the Strategic Management of Change course with the Strategic Analysis of Community risk reduction course. This approach would utilize a vision expressed by the Fire Chief and be implemented by a committee composed of BCFD personnel and community partners.

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APPENDIX A - Smoke Detector Survey

Address: _____ Date: _____

Name of caller: _____ Name of interviewee: _____

Good _____, my name is _____ and I work for the Battle Creek Fire Dept. We are conducting a safety survey. Your home has been randomly selected and I have a few questions to ask that will take less than 5 minutes and help make our city safer from fire.

Question #1:	Are you 18 years old or older?	Yes	No
Question #2:	Are you renting or buying your home?	Rent	Buy
Question #3:	Do you have at least one smoke detector?	Yes	No

Question #4A: **IF NO,** Would you like an appointment to have smoke detectors installed?

Yes No When _____

Question #4B: **IF YES**, Do you have at least one smoke detector on each level of the home, including the basement, and also one in the area of the sleeping rooms? Yes No

Question #5: Do your detectors use batteries or electricity? Bat - Elect - Both

Question #6: Finally, the last & most important question. Would you be willing to test your battery operated smoke detectors, while I hold, to see if they are working?

Yes No ***(If the interviewee does not want to test the detectors, because they report they know the status of the batteries, then record what the interviewee states regarding the batteries.)***

IF NO, Thank you for your participation. Good-bye.

IF YES, Please answer the following questions about the batteries.

_____ Number with good batteries

_____ Number with dead batteries

_____ Number with missing batteries

Reasons for missing batteries:

_____ Nuisance alarms

_____ Batteries needed elsewhere

_____ other, explain _____

APPENDIX B - BCFD Fatal Fire Log from 1947 through 1997

	DATE	ADDRESS	ID#	AGE & SEX	FIRE CAUSE
1.	03-17-51	Barney 47	n/a	Adult male-age n/a	Undetermined
2.	03-26-51	Seivor 110	n/a	Adult female age 80	Chimney
3.	11-29-52	Haskell 67	n/a	Child-age 8	Flamm. vapors
4.	12-05-52	University 65	n/a	Elderly male with stroke	Heating
5.	08-07-53	McCamly S 191	n/a	Adult male-age 18	Undetermined
6.	01-21-54	Highway 60	n/a	Adult male-age 82	Undetermined
7.	03-07-56	Champion 246	n/a	Adult female-age n/a	Smoking
8.	07-23-60	West 154	n/a	Adult male-age 36	Smoking
9.	12-28-61	Burnham E 374	n/a	Child-age 2	Child playing
10.	03-08-63	Calhoun 236	n/a	Adult female-age 62	Smoking
11.	12-12-66	Graves 240	n/a	Children 5, 3, & 2	Child playing
12.	02-14-77	Goguac 54 ½	0163	Adult male-age n/a	Undetermined
13.	02-18-83	Seedorf 27	0270	Child-age 7	Child laying
14.	05-08-85	Capital S. 2595	1416	Adult male-age 47	Undetermined
15.	10-29-85	Midway Ct 13	3463	Child-age 2	Child playing
16.	03-02-86	Capital S. 446	0741	Adult male-age 30	Electrical
17.	04-21-88	Latta 55	0979	Adult female-age 56	Electrical
18.	07-24-88	Howland 230	2187	Child-infant	Fireworks
19.	05-05-92	Calhoun 234	1622	Adult male-age 49	Smoking
20.	02-16-93	22nd St S. 28	0570	Children 5 & 6	Smoking
21.	02-18-93	Fourth St 28	0595	Handicapped male-age 34	Child playing
22.	02-28-94	Spencer 12	0814	Adult male-age 74	Smoking
23.	09-09-95	Grove 264	4073	Children 3 & 4	Arson
24.	01-18-96	Graves 177	0262	Adult female-age 79	Smoking
25.	04-16-97	Upton 49	2220	Children 3 & 4	Child playing
26.	05-10-97	Wentworth 546	2497	Adult female-age 61	Electrical
27.	08-14-97	Stiles 27	4369	Children 1 & 3 + 2 adults	Smoking
28.	11-12-97	Spencer 15	6100	Adult female-age 88	Electrical